



PATENT
Serial No. 09/383,889

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2-2703
B. Hilliard
1 of 3

IN THE UNITED STATES
PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellant(s) Donald F. Caldwell
Kenneth Ward Church
Glenn Stephen Fowler
Serial No. 09/383,889 Group Art Unit : 2163
Filing Date August 26, 1999
Docket No 113518 A Examiner: Greta Robinson
Title DATA COMPRESSION
METHOD AND APPARATUS

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APPEAL BRIEF

SIR:

This is an Appeal from a Final Office Action dated April 19, 2002, rejecting each of the pending claims 1-10. The Notice of Appeal was timely filed on July 19, 2002, and received by the Patent Office on July 24, 2002. The period to file this Appeal Brief, with a five-month extension pursuant to 37 CFR 1.136(a), expires on February 24, 2003.

1. REAL PARTY IN INTEREST

The real party in interest in the present appeal is AT&T Corp. See Assignment, recorded March 6, 2000, at Reel 010708, Frame 0084. AT&T Corp. is the assignee of the entire right, title, and interest in the above-identified application.

2. RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences.

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3. STATUS OF CLAIMS

The present patent application was filed on August 26, 1999, and contained claims 1-10. Appellants appeal the final rejection of claims 1-10. A copy of the appealed claims is attached hereto in the APPENDIX.

4. STATUS OF AMENDMENTS

Claims 1-10 stand as originally filed. No amendments have been made or entered.

5. SUMMARY OF INVENTION

The present invention relates to data compression, in general, and emanates from the inventors' observation that conventional compression techniques (e.g., the GZIP technique utilized pervasively in computer applications) provide sub-optimal results due to the way the data is presented to the compression application. The inventors recognized that simple metadata could be utilized to transform the data, before compression, in a manner that can optimize pre-existing known compression techniques such as GZIP.

A simple but powerful example is where the data is in tabular form, such as database records. Consider the following database of entries

Name	Rate	Hours
Beth	4.00	0
Dan	3.75	0
Kathy	4.00	10

A traditional way of storing such a database is in row major order, in other words, as something like "Beth, 4.00, 0; Dan, 3.75, 0; Kathy, 4.00, 10." Compression of such a database, it turns out, is sub-optimal to other ways of rearranging this same data. If the database is split into three columns of "Beth, Dan, Kathy", "4.00, 3.75, 4.00" and "0, 0, 10" and compressed together or separately, the compression results improve dramatically. As explained at length in the present specification, a compression application receiving the rearranged data can better take advantage of redundancies in related data.

The present invention presents numerous alternatives for automating this transformation process of the data, as well as explains why the techniques work from a technical point of view. The present invention essentially takes advantage of the fact that some fields have more information than others, and some interactions among fields are important, but most are not. Through the proper analysis of such interactions in the data, the present invention enables improvements in both space and time over conventional compression techniques.

6. ISSUES

The issues on appeal are

- (i) whether U.S. Patent No. 6,216,213 to Breternitz et al. anticipates each and every limitation of claims 1-5 and 7-10 under 35 U.S.C. 102(e) and
- (ii) whether claim 6 is patentable under 35 U.S.C. § 103(a) over U.S. Patent No. 6,216,213 to Breternitz in view of the article Houlding et al., "Low entropy image Pyramids for Efficient Lossless Coding."

7. GROUPING OF CLAIMS

A separate basis for patentability exists for each of claims 1-10, and the claims do not stand or fall together for purposes of this appeal. Nevertheless, for ease of analysis, the claims may be grouped as follows:

- A. Claims 1-4 are directed to a method for improving compression of a stream of data.
- B. Claim 5 is also directed to a method for improving compression of a stream of data.
- C. Claim 6 is also directed to a method for improving compression of a stream of data.
- D. Claims 7-10 are directed to an apparatus for improved compression of a stream of data.

8. ARGUMENT

This appeal presents the issue of whether U.S. Patent No. 6,216,213 to Breternitz Jr. et al. (hereinafter referred to as the “Breternitz patent”) discloses each and every limitation of the majority of claims in the present application. Appellants respectfully submit that the Examiner has based her rejections on an improper reading of the Breternitz patent and on an inappropriate construction of the pending claims. When the claims are properly construed, it becomes clear that the Breternitz patent is directed to a different technical issue and does not disclose the invention as claimed.

The Breternitz Patent

The Breternitz patent, unlike the present invention, is directed specifically to *instruction and data caches* that are used to improve the performance of *microprocessors* and *microcontrollers*. Modern microprocessors, such as the Intel Pentium (c) 4 Processor or the AMD Athlon(c), utilize advanced caching hardware to feed instructions and data to the central processing unit. As explicitly stated in the specification, the invention in the Breternitz patent concerns the compression of “instruction memory for use in a cache system.” Col. 2, lines 41-45. The specification in the Breternitz patent makes continual reference to “cacle lines” and “cache blocks.” As is well known in this field of art, a “cache line” or “cache block” is a unit of memory that can be transferred between the main memory and the cache. See, e.g., “The Free Online Dictionary of Computing,” <http://burks.brighton.ac.uk/burks/foldoc/17/16.htm>.

As discussed in the background section of the Breternitz patent, a recent advance in the use of such cache systems has been compression of the instruction cache in the microprocessor. See Col. 1, Lines 17-67. Microprocessor architectures – before the Breternitz patent – required translation of an address tag into a compressed address location to identify the location of a particular block of compressed memory instructions. See Col. 2, lines 1-13. The Breternitz patent simplifies this address translation process by providing a “one-to-one correlation between the address tag and the compressed memory.” See Col. 2, lines 53-67. This obviates the need in the prior art for a look-aside table (LAT) and compressed cache look-aside buffers (CLB) to decode sequentially addressed cache tags. It is this advantage over the prior art – simplifying the address translation process – that motivates the Breternitz patent and distinguishes it from the prior art.

The Examiner's Rejection

The Examiner rejected claims 1-5 and 7-10 under 35 U.S.C. § 102(e) solely over the Breternitz patent. Claim 6, a dependent claim, was rejected under 35 U.S.C. § 103(a) over the Breternitz patent in view of an article entitled "Low Entropy Image Pyramids for Efficient Lossless Coding." Accordingly, the Examiner's final rejection relies on the contention that the single reference, the Breternitz patent, discloses each and every limitation in claims 1-5 and 7-10.

Independent claims 1 and 7 require "transforming the data in accordance with a schema" where the "transformed data" is compressed in a subsequent limitation. The Examiner contends that the abstract and the following passage from the Breternitz patent fully discloses this transformation claim limitation:

After compression and upon subsequent decompression, this transformed address is to be quickly and unambiguously divisible into the starting address of the compressed cache line in compressed memory and the word offset identifying the instruction location within the cache line.

Col. 3, lines 24-29.

As pointed out in appellant's response to the Examiner's first office action, this rejection appears to reflect some confusion regarding what is being "transformed" in the above passage. What is being "compressed" in the Breternitz patent are *processor instructions* in the cache line. What is being "transformed" in the passage above are specifically *addresses* to locating the processor instructions in the cache memory. Accordingly, the data to be compressed, namely the processor instructions in the cache line, are not "transformed" – let alone "transformed in accordance with a schema."

As noted in the present invention, transformation "in accordance with a schema" requires "partitioning and reordering the data in a manner that optimizes the compression of the input data." Page 5, Lines 19-21. The Breternitz patent does not disclose "reordering" or rearranging the compressed data in any manner and is unconcerned with optimization of the compression process itself. Instead, the Breternitz patent is directed to the unrelated issue of optimizing a microprocessor architecture to quickly locate the compressed processor instructions in the cache memory. It does this by "transforming" the addresses, not the processor instructions.

The inapplicability of the Breternitz patent is further reinforced when looking at some of the dependent claims. Dependent claims 3 and 9 further clarify the "transformation step" by including the limitation of "reordering the data into column major order" as in the example

given above in the summary of invention. The Examiner's only citation to Breternitz, which the Examiner contends discloses this limitation in its entirety, is to element 140 in FIG. 1 of the Breternitz patent. Element 140 reads: "COMPACT EACH COMPRESSED CACHE-LINE BLOCK INTO MEMORY." As mentioned above, the "cache line" is well-known term in microprocessor architectures which refers to a data channel between main memory and a hardware cache. The cache line is separated into cache line "blocks" which are addressed using the scheme disclosed in the Breternitz patent.

There is no disclosure in the Breternitz patent of rearranging the data – let alone "reordering the data into column major order."

A claim is anticipated under Section 102 only "if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987); MPEP 2131. "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236 (Fed. Cir. 1989). Under no reading of the Breternitz patent can it be said that each and every element of claims 1-5 and claims 7-10 of the present application were disclosed, as required under Section 102.

Applicants respectfully submit that the claims represent allowable subject matter. Accordingly, a Notice of Allowance to this effect is earnestly solicited.

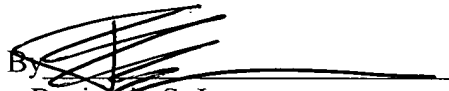
CONCLUSION

In summary, the pending claims 1-10 are patentable over the Breternitz patent. The Breternitz patent is directed to an unrelated technical area of microprocessor cache addressing and does not disclose optimizing compression by reordering the data to be compressed. A reversal of the Examiner's Final Rejection is respectfully solicited.

The Office is hereby authorized to charge any additional fees or credit any overpayments under 37 C. F. R. 1.16 and 1.17 to **AT&T Corp. Deposit Account No. 01-2745 .**

Respectfully submitted,
Donald F. Caldwell
Kenneth Ward Church
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Date: February 19, 2003

By 
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APPENDIX

(BRIEF of Appellants Caldwell et al., U.S. Patent Application, Serial No. 09/383,889)

CLAIMS ON APPEAL

1. A method for improving compression of a stream of data comprising:
transforming the data in accordance with a schema; and
compressing the transformed data.
2. The method of claim 1 wherein the transformation step further comprises the step of partitioning the data into a first and second portion which are separately compressed.
3. The method of claim 1 wherein the transformation step further comprises the step of reordering the data into column major order.
4. The method of claim 3 wherein the transformation step further comprises the step of partitioning the data into columns which are separately compressed.
5. A method for retrieving a stream of data from a stream of compressed data which has been compressed in accordance with claim 1, the method comprising:
decompressing the compressed data; and
transforming the data in accordance with a schema.
6. A method for generating a schema for improving compression of a stream of data comprising:
separating a sample of the data into a first portion of low entropy and a second portion of high entropy;
partitioning the second portion into columns;
searching for combinations of columns that minimize the compressed size of the sample.
7. An apparatus for improved compression of a stream of data comprising:
means for transforming the data in accordance with a schema; and
means for compressing the transformed data.

8. The apparatus of claim 7 wherein the transforming means further comprises means for partitioning the data into a first and second portion which are separately compressed.

9. The apparatus of claim 7 wherein the transforming means further comprises means for reordering the data into column major order.

10. The apparatus of claim 9 wherein the transforming means further comprises means for partitioning the data into columns which are separately compressed.

TRANSMITTAL FORM <i>(to be used for all correspondence after initial filing)</i>	Application Number	09/383889
	Filing Date	08/26/1999
	First Named Inventor	Donald F Caldwell et al.
	Group Art Unit	2177
	Examiner Name	G. Robinson
Total Number of Pages in this Submission	Attorney Docket Number	113518A

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Enclosures (check all that apply)		
<input checked="" type="checkbox"/> Fee Transmittal Form <input type="checkbox"/> Fee Attached <input type="checkbox"/> Amendment / Response <input type="checkbox"/> After Final <input type="checkbox"/> Affidavits / Declaration(s) <input checked="" type="checkbox"/> Extension of Time Request <input type="checkbox"/> Express Abandonment Request <input type="checkbox"/> Information Disclosure Statement <input type="checkbox"/> Certified Copy of Priority Document(s) <input type="checkbox"/> Response to Missing Parts under 37 CFR 1.52 or 1.53 <input type="checkbox"/> Response to Missing Parts/Incomplete Application	<input type="checkbox"/> Assignment & Recordation Cover Sheet <input type="checkbox"/> Drawing(s) & Letter to Official Draftsman <input type="checkbox"/> Licensing-related Papers <input type="checkbox"/> Petition to the Commissioner <input type="checkbox"/> Petition to Convert a Provisional Application <input type="checkbox"/> Power of Attorney, Revocation Change of Correspondence Address <input type="checkbox"/> Terminal Disclaimer <input type="checkbox"/> Request for Refund	<input type="checkbox"/> After Allowance Communication to Group <input type="checkbox"/> Appeal Communications to Board of Appeals and Interferences <input checked="" type="checkbox"/> Appeal Communications to Group <i>(Appeal Notice, Brief, Reply Brief)</i> <input type="checkbox"/> Proprietary Information <input type="checkbox"/> Status Letter <input checked="" type="checkbox"/> Return Receipt Postcard <input type="checkbox"/> CD, Number of CDs <input type="checkbox"/> Additional enclosure(s) <i>(please identify below)</i> <div style="border: 1px solid black; height: 20px; width: 100%;"></div>
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